Post-harvest yield and protein assessment tools

• Grain protein as an indicator of yield

• Did you meet your yield and protein goals?

• How much nitrogen did it take to produce the crop?
• How can I improve (reduce this number or grow more wheat with the same amount of nitrogen)?
Yield-protein relationships in wheat
(in the absence of severe stress during grain filling)

- Maximum grain yield at
  - ~10% protein for soft white wheats
  - ~12.5% protein for hard red spring
  - ~11% for hard red winter and hard white

- For hard wheats, it's critical to accurately estimate yield in order to achieve protein goals
Post-harvest yield and protein assessment

- What do these indicate?
  - Low yield, low protein
  - Low yield, high protein (and low test weight)
  - High yield, low protein
  - High yield, high protein
Post-harvest yield and protein assessment

• Low yield, low protein
  - Low N available; severe under-fertilization or N loss

• Low yield, high protein (low test weight)
  - Stress, over-fertilization; high residual N left in soil

• High yield, low protein
  - Target met for soft white; under-fertilized for hard wheat protein goal?

• High yield, high protein
  - Over-fertilized soft white wheat?; target met for hard wheat
Post-harvest assessment of unit N supply requirement/nitrogen use efficiency

- How much N did it take to produce your crop (lb/bushel)?
- Total N supply (soil + fertilizer contributions) ÷ yield = lb N/bushel for your situation
- Compare to average unit N supply requirement for the market class (e.g., 2.7 lb N/bu for soft white wheat)
Average nitrogen supply requirements

- Unit N supply (soil+fertilizer) requirement for different market classes of wheat
  - Soft white winter and spring: 2.7 lb N/bushel
  - Hard red winter: 3.0 lb N/bushel
  - Hard red spring: 3.6 lb N/bushel
  - Hard white winter/spring: 3.2 lb N/bushel
Where does the nitrogen go?

• 2.7 lbs nitrogen supply per bushel soft white
• At 10% grain protein, grain contains 1 lb N/bu
• $2.7 - 1 = 1.7$ lb N/bushel left in field
  - Straw = ~0.40 lb N/bu $\rightarrow$ organic matter
  - Remainder (~50%, or 1.3 lb N/bu) $\rightarrow$ future residual N in the soil test and available to subsequent crop
  - Loss?
Aaron’s slides
Your turn

• What’s your number?
Share and discuss numbers
Post-harvest analysis of unit N supply requirement

• What is your number?

• >2.7 lb N/bu for soft white winter wheat?
  - Post-harvest soil sampling finds significant N in soil
    • Over-fertilizing/optimistic yield goal
  - Post-harvest soil sampling finds little residual N
    • N losses likely
    • Split applications, stabilizers

• <2.7 lb N/bu for soft white winter?
  - Great!
  - Opportunity for further improvement – how low can you go?
Post-harvest analysis of $N$ uptake efficiency

- What is your number?
  - More than 50%?
    - Great!
    - Opportunity for further improvement?
  - Less than 50%
    - Post-harvest soil sampling finds significant residual $N$
      - Over-fertilizing/overly optimistic yield goal, crop stress
    - Post-harvest soil sampling finds little residual $N$
      - $N$ losses likely
      - Split applications, stabilizers
Aaron’s conclusion slides